



## Subject card

Subject name and code	Chemistry of construction materials, PG_00061706						
Field of study	Civil Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study		
Mode of study	Part-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Environmental Engineering Technology -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Aneta Łuczkiwicz					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	10.0	15.0	0.0	0.0	40
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	40		5.0		80.0	125
Subject objectives	<ol style="list-style-type: none"><li>1. To acquaint students with the basics of chemistry for civil engineers and general chemistry at the academic level</li><li>2. To acquaint students with the chemical characteristics of various building materials</li><li>3. Presentation of aspects related to the creation and destruction of various classes of building materials</li><li>4. Acquainting students with the chemical aspects of building materials protection against destruction (including corrosion protection)</li><li>5. Acquainting students with the laboratory research of building materials</li></ol>						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W01] Demonstrate knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering at a level necessary to achieve the other programme outcomes.	01 - knows and understands the basic concepts and laws of general chemistry, discussed during classes,	[SW1] Assessment of factual knowledge
	[K6_U01] Apply knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering to solve engineering problems and issues.	01 - can use the known laws and relationships for chemical calculations (in particular regarding concentrations of solutions, pH of solutions);	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
	[K6_U02] Analyse & solve engineering issues & problems in the field of civil engineering by applying appropriate and relevant established analytical, numerical and experimental methods.	01 - can cooperate in a small team performing chemical determinations and prepare reports on the results obtained during the experiments; 02 - uses laboratory equipment, with which he performs and interprets simple quantitative determinations;	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment
	[K6_W05] Demonstrate knowledge and understanding of research methods (obtaining information, simulations, experimental methods) in the field of civil engineering.	01 - is able to apply the basic concepts and laws of general chemistry, discussed during classes to the description of chemical processes; 02 - is aware of the dangers of working in a chemical laboratory and knows the rules of occupational health and safety and observes them.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	<p><b>LECTURE</b></p> <ol style="list-style-type: none"> <li>1. The structure of materials, the built-up of molecules and atoms</li> <li>2. Types of chemical bonds and their characteristics; Types of chemical reactions occurred in civil engineering</li> <li>3. Characterization of homogenous and heterogenous material systems; dispersion systems.</li> <li>4. Role of water in building materials (Chemical equilibriums. The concept of pH. Dissociation. Hydrolysis of salts)</li> <li>5. Electrochemistry. Redox processes, corrosion of metals</li> <li>6. Inorganic construction binders. Gypsum and lime</li> <li>7. Inorganic construction binders. Cement</li> <li>8. Inorganic construction binders. Factors influencing the binding of cement. Cement corrosion</li> <li>9. Organic construction binders. (Polymers additives, resins etc.)</li> <li>10. Chemia materiałów organicznych (chemia bitumów, chemia drewna)</li> <li>11. Novelty in the field of chemistry in civil engineering-new products and applications in the context of circular economy approach</li> </ol> <p><b>LABORATORY</b></p> <p>ACTIVITY 1: Qualitative analysis of mixing water</p> <p>ACTIVITY 2: Determining the color of the water and determining the aggressive CO<sub>2</sub></p> <p>ACTIVITY 3: Water hardness analysis Determining the acidity and alkalinity of water; pH measurement</p> <p>ACTIVITY 4: Determination of chloride and sulfate ions (VI), determination total alkalinity and calculation of the Larson-Skold index</p> <p>ACTIVITY 5: Morphology of building materials - microscopic analysis</p> <p><b>EXERCISES</b></p> <p>Computational tasks taking into account the following issues: mol, equivalents, percentage composition, reaction stoichiometry, writing chemical equations; molar and normal concentrations; percentages, balancing redox reactions; water hardness - conversion of indicators; electrolytic dissociation, pH;</p>														
Prerequisites and co-requisites	<ol style="list-style-type: none"> <li>1. The student has basic knowledge of general chemistry (solves basic computational problems, correctly writes equations of simple chemical reactions reaction reaction stoichiometry)</li> <li>2. The student knows the symbols of chemical elements as well as the molecular and structural formulas of basic acids, bases and salts</li> <li>3. The student knows the basic physical and chemical phenomena (e.g. phase transitions of water, neutralization reaction)</li> <li>4. Is aware of the importance of chemical phenomena in social life and the civil engineering.</li> </ol>														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Report</td> <td>60.0%</td> <td>30.0%</td> </tr> <tr> <td>Test</td> <td>60.0%</td> <td>30.0%</td> </tr> <tr> <td>Test</td> <td>60.0%</td> <td>40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Report	60.0%	30.0%	Test	60.0%	30.0%	Test	60.0%	40.0%
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Recommended reading	Basic literature	<ul style="list-style-type: none"> <li>• T. Broniewski, L. Czarnecki, O. Henning Chemia w budownictwie, Wydawnictwo Arkady, Warszawa, 2018</li> <li>• Edward Szymański Materiały budowlane Tom 1, Podręczniki Wyższej Szkoły Ekologii i Zarządzania, 2011</li> </ul>													

	Supplementary literature	<p>Open AGH e-textbooks - peer-reviewed academic-level e-textbooks for science, developed by AGH employees for any use.</p> <p>Link: <a href="https://epodreczniki.open.agh.edu.pl/openagh-podreczniki.php?categId=82">https://epodreczniki.open.agh.edu.pl/openagh-podreczniki.php?categId=82</a></p> <p><b>Chemistry for civil engineers:</b> <a href="https://emkhk.bme.hu/wp-content/uploads/2015/11/CHEMISTRY-FOR-CIVIL-ENGINEERS-Supplementary-Academic-Educational-Material.pdf">https://emkhk.bme.hu/wp-content/uploads/2015/11/CHEMISTRY-FOR-CIVIL-ENGINEERS-Supplementary-Academic-Educational-Material.pdf</a></p>
Example issues/ example questions/ tasks being completed	eResources addresses	<p>Adresy na platformie eNauczenie:</p> <p>What is the pH of the solution in which the concentration of hydroxide ions is <math>3.5 \cdot 10^{-5} \text{ mol / dm}^3</math>.</p> <p>What are asphaltenes?</p> <p>What is the phenomenon of corrosion?</p> <p>How is an atomic bond different from an ionic bond?</p>
Work placement		Not applicable